

AMENDMENT TO THE CLAIMS

1. (Currently Amended) A method for manufacturing a semiconductor device comprising:

a first step of forming an insulating film including a contact hole on a substrate;

a second step of forming a conductive underlying layer on the insulating film inclusive of the sidewall surface and the bottom surface of the contact hole;

a third step of subjecting the underlying layer to sputter-etching so that a part of the underlying layer deposited on the bottom surface of the contact hole is at least partially deposited on the lower part of the sidewall surface of the contact hole; and

a fourth step of forming a metal layer on the underlying layer by plating,

wherein in the third step, a film thickness of the underlying layer deposited on the lower part of the sidewall surface of the contact hole increases while a part of the underlying layer remains on the bottom surface of the contact hole.

2. (Original) The method for manufacturing the semiconductor device of Claim 1 wherein

the underlying layer is a plating seed layer made of metal, and

the plating seed layer and the metal layer contain copper as a main ingredient.

3. (Original) The method for manufacturing a semiconductor device of Claim 1 wherein

the underlying layer is a barrier layer for preventing atoms constituting the metal layer from diffusing into the insulating film, and

the method further comprises, between the third step and the fourth step, a fifth step of forming a plating seed layer made of metal on the barrier layer inclusive of the sidewall surface and the bottom surface of the contact hole.

4. (Currently Amended) The method for manufacturing a semiconductor device of Claim 3, said method further comprising, between the fifth step and the fourth step, a sixth step of subjecting the plating seed layer to sputter-etching so that a part of the plating seed layer deposited on the bottom surface of the contact hole is at least partially deposited on the lower part of the sidewall surface of the contact hole,

wherein in the sixth step, a film thickness of the plating seed layer deposited on the lower part of the sidewall surface of the contact hole increases while a part of the plating seed layer remains on the bottom surface of the contact hole.

5. (Original) The method for manufacturing a semiconductor device of Claim 3 wherein the plating seed layer and the metal layer contain copper as a main ingredient.

6. (Original) The method for manufacturing a semiconductor device of Claim 3 wherein in the third step, a portion of the barrier layer deposited on the bottom surface of the contact hole is removed.

7. (Original) The method for manufacturing a semiconductor device of Claim 3 wherein the barrier layer is made of high melting point metal or nitride of the high melting point metal.

8. (Original) The method for manufacturing a semiconductor device of Claim 3 wherein the barrier layer comprises a lower barrier layer made of nitride of high melting point metal and an upper barrier layer made of high melting point metal, and

the second and third steps are performed for each of the lower barrier layer and the upper barrier layer.

9. (New) The method for manufacturing a semiconductor device of Claim 1, wherein in the third step, an overhang portion of the underlying layer at the upper end of an opening of the contact hole decreases while the film thickness of the underlying layer deposited on the lower part of the sidewall surface of the contact hole increases.

10. (New) The method for manufacturing a semiconductor device of Claim 1, wherein in the third step, the contact hole is uniformly covered with the underlying layer while the film thickness of the underlying layer deposited on the lower part of the sidewall surface of the contact hole increases.

11. (New) The method for manufacturing a semiconductor device of Claim 1, wherein in the second step, the underlying layer is deposited by a sputtering method in which DC source power is applied to a target, and

in the third step, the DC source power is reduced, RF power is applied to the substrate, and a sputter-etching process employing argon gas is performed to the underlying layer.

12. (New) The method for manufacturing a semiconductor device of Claim 4, wherein in the sixth step, an overhang portion of the plating seed layer at the upper end of an opening of the contact hole decreases while the film thickness of the plating seed layer deposited on the lower part of the sidewall surface of the contact hole increases.

13. (New) The method for manufacturing a semiconductor device of Claim 4, wherein in the sixth step, the contact hole is uniformly covered with the plating seed layer while the film thickness of the plating seed layer deposited on the lower part of the sidewall surface of the contact hole increases.

14. (New) The method for manufacturing a semiconductor device of Claim 4, wherein in the fifth step, the plating seed layer is deposited by a sputtering method in which DC source power is applied to a target, and

in the sixth step, the DC source power is reduced, RF power is applied to the substrate, and a sputter-etching process employing argon gas is performed to the plating seed layer.